

# **DUAL-LAYER HEAT DISSIPATING STRUCTURE**

## **BACKGROUND OF THE INVENTION**

The present invention relates to a dual-layer heat dissipating structure and, more particularly, to a dual-layer heat dissipating structure which  
5 employs a heat pipe between two heat sinks, while connection between two heat sinks is reinforced.

The advancement of computer technology has introduced various types of high-precision electronic devices. The improved functions and operation speed of these electronic devices has consequently produced great amount of  
10 heat. How to effectively dissipate the heat generated by the electronic devices, and how to maintain the operation temperature of the electronic devices has become an important topic in industry.

Figure 1 shows a conventional heat dissipating structure 1a. The heat dissipating structure 1a uses a heat pipe 10a serially connecting two heat sinks  
15 11a and 12a. When the lower heat sink 12a is in contact with the heat generating electronic device, a part of the heat is conducted towards the upper heat sink 11a, such that the heat dissipating area is enlarged, and the heat dissipation efficiency is enhanced.

However, in the above heat dissipation structure 1a, the connection of  
20 heat sinks 11a and 12a are maintained by the heat pipe 10a only. No adhesive or joining structure is applied in such structure. As the strength of the heat pipe is generally weak, the heat dissipation structure 1a can hardly pass the falling test while an external force is applied thereto.

## **BRIEF SUMMARY OF THE INVENTION**

The present invention provides a dual-layer heat dissipating structure, which comprises two heat sinks connected to each other. Therefore, the heat sinks are integrated into one body, and the jointure is reinforced.

The dual-layer heat dissipating structure includes a first heat sink and a  
5 second heat sink aligned with each other, and a heat pipe with a connecting portion and a curved portion for interconnecting the first and second heat sinks.

Wherein each of the first and second heat sink includes a substrate, and two end plates protruding perpendicularly from two opposing ends of the  
10 substrate. Two substrates each includes at least one slot through out of two corresponding end plates of the same side for locating the connecting portion, the corresponding end plates each include an opening with respect to the slot for partially moving in the curved portion, and the end plates of the second heat sink are aligned and engaged with the end plates of the first heat sink.

## 15 BRIEF DESCRIPTION OF THE DRAWINGS

These, as well as other features of the present invention, will become apparent upon reference to the drawings wherein:

Figure 1 shows a conventional heat dissipating structure;

Figure 2 shows an exploded view of the dual-layer heat dissipating  
20 structure provided by the present invention;

Figure 3 shows a perspective view of Figure 2;

Figure 4 shows a cross-sectional view of Figure 3 according to a first preferred embodiment;

Figure 5 shows an expanded view of part A of Figure 4;

25 Figure 6 shows a cross-sectional view of Figure 3 according to a second preferred embodiment;

Figure 7 shows an expanded view of part A of Figure 6;

Figure 8 shows an exploded view of a third preferred embodiment of the present invention;

Figure 9 shows an exploded view of a fourth preferred embodiment of the present invention; and

5        Figure 10 shows the deformation of the slit and the protrusion of the end plates after pressing.

## DETAILED DESCRIPTION OF THE INVENTION

Figures 2, 3 and 4 show an exploded view, a perspective view and a cross-sectional view of the dual-layer heat dissipating structure provided by  
10    the present invention. As shown, the heat dissipating structure includes a first heat sink 11, a second heat sink 12 and at least one heat pipe 10.

The first and second heat sinks 11 and 12 can be made of material with good thermal conductivity such as copper and aluminum. Each of the first and second heat sinks 11 and 12 includes a substrate 110 and 120, a pair of  
15    end plates 111 and 121, and a plurality of parallel fins 112 and 122 between the end plates 111 and 121, respectively. In this embodiment, the substrates 11 and 12 have a rectangular shape. The end plates 111 and 112 protrude perpendicularly from two opposing ends of the substrate 110 and 120 and serve as exterior fin, respectively. The fins 112 and 122 protrude  
20    perpendicularly from the substrate 110 and 120 between the end plates 111 and 112, respectively. The fins 112 and 122 are permanently connected to the substrate by thermal conductive adhesive or other soldering material such as tin.

A part of the substrate 120 of the second heat sink 12 is recessed to  
25    form a receiving slot 126. A thermal conductive block 13 is embedded in the second heat sink 12 at the receiving slot 126. Preferably, the thermal conductive block 13 is fabricated from material with thermal conductivity

better than that of the second heat sink 12. Therefore, when the heat sink 12 is fabricated from aluminum, the thermal conductive block 13 can be formed of copper, for example. The thermal conductive block 13 is a planar plate for directly and smoothly attaching to the heat generating electronic device such as the central processing unit (not shown).

The heat pipe 10 includes two parallel horizontal elongate members 101 and 102, interconnected to a vertical elongate member 100 by two curved member 103. The curved member 103 is used as a heat conducting part, while the upper and the lower horizontal elongate member 101 and 102 serve as a heat dissipating part and a heat receiving part, respectively. Preferably, the upper horizontal elongate member 101, the lower horizontal elongate member 102 and the vertical interconnecting member 100 are integrally formed. The upper horizontal elongate member 101 is connected to the first heat sink 11, while the lower horizontal elongate member 102 is connected to the second heat sink 12. On the same side of the substrates 110 and 120, it is formed a slot 113 and 123 through out of one of the end plates 111, 121, allowing the upper and lower horizontal elongate members 101 and 102 to insert through, respectively. Meanwhile, a consecutive slot 130 are formed on the thermal conductive block 13 corresponding the slot 123 of the second heat sink 12, so that the lower horizontal elongate member 102 is located in the slots 123 and 130.

While assembling the first and second heat sinks 11 and 12, the end plates 111 are aligned with the end plates 121, such that the terminuses of each pair of aligned end plates 111 and 121 are brought in contact with each other. The terminuses of each pair of aligned end plates 111 and 121 further comprises a pair of snapping structures, such that the first and second heat sink 11 and 12 can be attached to each other by the snapping structures. Further, soldering material is injected into the joint between the terminuses of

the aligned end plates 111 and 121 and cured afterwards. Therefore, the connecting strength of the first and second heat sinks 11 and 12 is reinforced.

As shown in Figures 4 and 5, a recessed channel 114 is formed on the terminus of each end plate 111, while a protruding rib 124 is formed on the terminus of each end plate 121. Both the recessed channels 114 and protruding ribs 124 extend through the whole lengths of the terminuses of the end plates 114 and 124, respectively. The protruding ribs 124 can be snapped into the recessed channels 114 and leave a gap between each pair of the end plates 111 and 121. The gap is then filled with soldering material, which is then cured to reinforce the connection between the end plates 111 and 121.

In the above embodiment, the protruding ribs 124 have an oval cross-sectional view.

Furthermore, referring Figures 2 to 4 again, due to two horizontal elongated member 101, 102 and the vertical elongated member 100 of the heat pipe 10 cannot have a right-angled connection therebetween. The above-mentioned curved members 103 are then provided. However, the curved member 103 has fixed curvature and curving radian. That is, when the heat pipe 10 is furnished, the vertical elongated member 100 may not move closely to the first and second heat sinks 11 and 12. Therefore, the distance between the vertical elongated member 100 and the heat sinks 11, 12 will increase the bulk structure of the present heat dissipating assembly. As such, by forming an opening 115, 125 corresponding to the hole 113, 23 on the end plate 111, 121 of the heat sink 11, 12, respectively, the curved members 103 can partially move in the openings 115, 125 to shorten the distance between the vertical elongated member 100 and the heat sinks 11, 12, as shown in Figure 4.

Accordingly, a dual-layer heat dissipating structure is formed.

Figures 6 and 7 show a second embodiment of the present invention. Figure 6 is a cross-sectional view, while Figure 7 is an enlarged view of area A as shown in Figure 6. In this embodiment, the protruding rib 124 has a dovetail cross section, while the recessed channel 114 is configured to conform to the dovetail cross section.

Figure 8 shows an exploded view of a third embodiment of the present invention. In this embodiment, the first and second heat sinks 11 and 12 are aluminum extruded heat sinks. That is, each of the fins 112 and 122 is integrally formed on the substrates 110 and 120, respectively.

As shown in Figures 9, the above-mentioned snapping structure includes a slit 116 and a protrusion 127. The slit 116 and the protrusion 127 are formed on each two corresponding end plates 111, 121 of the heat sinks 11, 12. For example, the first heat sink 11 has the slit 116 and the protrusion 127 formed on each end plate 111, while the second heat sink 12 has the protrusion 127 and the slit 116 formed on the corresponding end plate 121, respectively. Therefore, the heat sinks 11 and 12 may be identical by molding. After the heat sinks 11 and 12 are mounted together, the engagement of the slit 116 and the protrusion 127 thereof are well performed by simply pressing the end plates 111 and 121 to deform the slit 116 and protrusion 127, as shown in Figure 10.

This disclosure provides exemplary embodiments of the present invention. The scope of this disclosure is not limited by these exemplary embodiments. Numerous variations, whether explicitly provided for by the specification or implied by the specification, such as variations in shape, structure, dimension, type of material or manufacturing process may be implemented by one of skill in the art in view of this disclosure.